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Linan Guan, Jianwei Shen

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Self-Organized Pattern Dynamics of Somitogenesis model in Embryos

Linan Guan[a], Jianwei Shen[b]

[a] *School of Aerospace Engineering and Applied Mechanics, Tongji University, Shanghai 200092, P.R.China*

[b] *Institute of Applied Mathematics, Xuchang University,Xuchang, Henan 461000, P.R.China*

Abstract

Somitogenesis, the sequential formation of a periodic pattern along the antero-posterior axis of vertebrate embryos, is one of the most obvious examples of the segmental patterning processes that take place during embryogenesis and also one of the major unresolved events in developmental biology. In this paper, we investigate the effect of diffusion on pattern formation use a modified two dimensional model which can be used to explain somitogenesis during embryonic development. This model is suitable for exploring a design space of somitogenesis and can explain many aspects of somitogenesis that previous models cannot. In the present paper, by analyzing the local linear stability of the equation, we acquired the conditions of Hopf bifurcation and Turing bifurcation. In addation, the amplitude equation near the Turing bifurcation point is obtained by using the methods of multi-scale expansion and symmetry analysis. By analyzing the stability of the amplitude equation, we know that there are various complex phenomena, including Spot pattern, mixture of spot-stripe patterns and labyrinthine. Finally, numerical simulation are given to verify the correctness of our theoretical results. Somitogenesis occupies an important position in the process of biological development, and as a pattern process can be used to investigate many aspects of embryogenesis. Therefore, our study helps greatly to cell differentiation, gene expression and embryonic development. What's more, it's of great significance for the diagnosis and treatment of human diseases to study the related knowledge of

Corresponding auther:xcjwshen@gmail.com